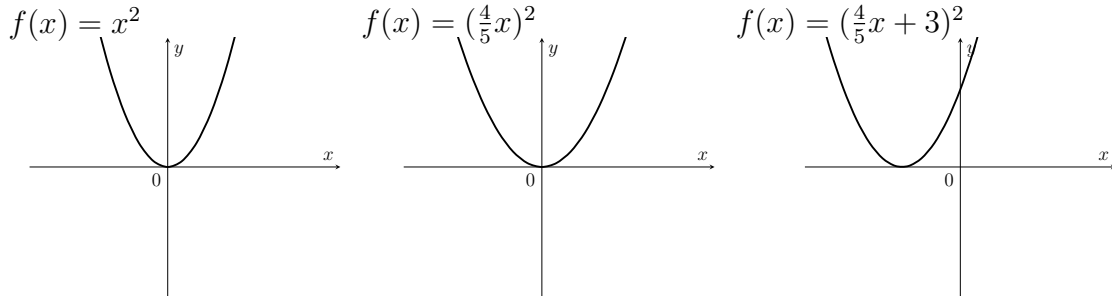U of I MAC Handouts:
Graph Transformation Handout

Note: Graph transformation is the process by which existing graph are modified. There are a total of 6 transformations.

"Order of Operations" for Transformations		
Horizontal Shifts	Horizontal Stretch/Compression	Reflection About Y-axis
Shifts Left: $y = f(x + c)$ Shifts Right $y = f(x - c)$	$y = f(ax)$ Stretch When: $a > 1$ Compress When: $0 < a < 1$	$y = f(-x)$ Reflecting $y = f(x)$ about the y-axis
Vertical Stretch/Compression	Reflection About X-Axis	Vertical Shifts
$y = af(x)$ Stretch When: $a > 1$ Compress When: $0 < a < 1$	$y = -f(x)$ Reflecting $y = f(x)$ about the x-axis	Shifts Up: $y = f(x) + c$ Shifts Down: $y = f(x) - c$

*Note: Order of Transformations is horizontal stretch/compression, reflecting the y-axis, horizontal shifts, vertical stretch/compression, reflecting the x-axis and then vertical shifts.

This handout and others are available on the University of Idaho MAC web page:
https://www.uidaho.edu/sci/mathstat/mac/math-resources

Example Problem

Using What You Learned to Sketch: $y = -5(\frac{4}{5}x + 3)^2 - 1$

$f(x) = x^2$

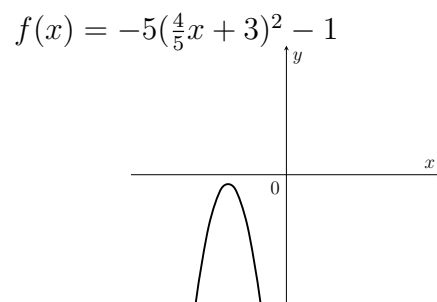$f(x) = (\frac{4}{5}x)^2$

$f(x) = (\frac{4}{5}x + 3)^2$

We start with our base function of $y = x^2$. The graph will horizontally compress since $0 < a < 1$.

Then, it will horizontally shift 3 units to the LEFT.

$f(x) = 5(\frac{4}{5}x + 3)^2$

$f(x) = -5(\frac{4}{5}x + 3)^2$
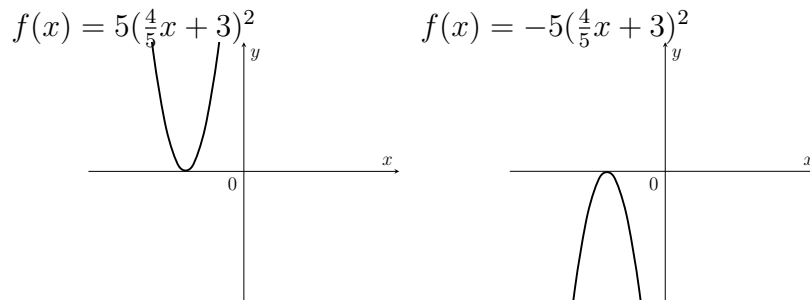
The graph will then vertically stretch since $a > 1$.

The graph will reflect about the x-axis because of the negative sign.

$f(x) = -5(\frac{4}{5}x + 3)^2 - 1$

Lastly, the graph will vertically shift 1 unit DOWN.